The Theory and Practice of Panchagavya

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Content

Author's Note….

The daily routine of every rural household is to collect the cow dung admixtured naturally with urine, make into fluid by dilution with water and sprinkle at the front yard to cleanse the frontage of the house. The farmers also cleanse the yards before the harvest with the cow dung solution, making use of leafy twigs of neem as brush. How come the cow dung and urine diluted with water act as a disinfectant and supposed to kill all the pathogens?

A small experiment was done to confirm this effect. The cow dung urine mix was centrifuged inrefrigerated centrifuge @10000 rpm and the supernatant liquid was collected and applied over the agar medium in perti dish in different calculated quantities. All kinds of fungi were inoculated over the media and examined periodically. In all perti dishes, irrespective of the dosage, there were no fungal growth including E.Coli and Salmonella.

This has intrigued to go for further experimentations with crops and with all combinations of organics including the panchagavya, a blend of five products of cow viz., dung, urine, milk, curd and ghee. Along with Dr. K. Natarajan MBBS, Kodumudi ,Erode district (TN), I had the opportunity to listen to the views of the farmers who regularly use Panchagavya and visited the fields where the effects were witnessed in reality when panchagavya was sprayed on plants.

Further my visit to M/s POABS organic farms , Nelliampathi, Kerala where 1200 acres of Coffee, tea, cardamom, pepper and pineapple are being grown biodynamically (which is akin to the use of panchagavya in agriculture plus synchronizing the activities of the farm activities with lunar and solar rhythms) helped to develop a Cosmo vision on agriculture . Further a visit to the organic farm of Mr.Anthonisami of Puliangudi in Tinneveli district (TN) where 40 acres of Acid lime was literally with organics and particularly the Panchagavya made

me thirsty of understanding the physiological process in plants in response to Panchagavya application.

Then experiments were designed as a kind of reverse engineering to scientifically validate the effects witnessed and specifically on the following metabolic processes:

01. Earliness in flowering irrespective of the crop
01. Drought hardiness and hard nature of the canopy
02. Retention of flavour , aroma and shelf life of the produce
04. Seed fill and weight gain in all the seedy crops

I profusely thank Dr.K.Ramasamy Director Centre for Plant Molecular Biology, Dr. P.Murugesan for their support in analyzing the panchagavya in various laboratories. My sincere thanks are to all my Post Graduate students who have pioneered to explore the unexplored area of research on panchagavya. My gratitude is due to Dr.K.Natarajan , President of Rural Community Action Centre,MBBS,. who is spearheading the Panchagavya movement as ONE MAN ARMY in TN against many odds. I am sincerely acknowledging the priceless technical support rendered by late Dr.A.Subramanian MVSc former Managing Director, Aavin, Coimbatore and laboratory experiment support provided by Dr.Rana ,Director, Institute of Communicable Diseases , New Delhi. The secretarial service rendered by Ms.S.P.Thamaraiselvi and Ms.Cynthia Starlin Emily for the publication of this document is sincerely acknowledged.

My appreciations to all the organic farmers who I met during workshops and seminars on Panchagavya, for their enthusiasm in sharing the 'on farm experiences' with panchagavya which are worth further scientific scrutiny. Eg

'The person who sprays the Panchagavya was ridden off the skin ailments and regained the loss of appetite and the sense of well being.'

'The dragon flies over the field is an indication that the field was sprayed with panchagavya'

'When one walks in the paddy field in the early morning, the dhoti becomes yellow because of the filch of pollen grains up t knee height'

The idea of publishing this document is to further promote the investigation of Panchagavya which is at present not exhaustive, and has the potential for extensive use in crop production. There are areas of Panchagavya research to explore for the farmers, agricultural scientists, vetenarians and physicians. I welcome every one to join hands to provide a healthy crop culture

vis a vis ensure health and well being of all living beings that inhabit the mother earth this day and in future.

(E.Vadivel)
8th October 2007
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Author's Note for the Second edition

Over the past four years, the use of Panchagavya in agriculture has visibly gained a place. That too for organic farmers, it has become the mightiest tool. Different versions of Panchagavya were also being prepared with different quantities and with additions of other ingredients like sugarcane juice and jaggery and experimented by the farmers themselves. There are two categories of producers now. One category produces for self use in his farm and spares the balance quantity of the prepared Panchagavya, if any, to friends and relatives. The second category manufactures exclusively on commercial scale to sell the produce to others for gain. As in any business, the commercial production gives way for ' *small adjustments'* to make more gain. The possibility for the use of sub standard ingredients also cannot be ruled out. More over the raw materials are sourced by the farmers themselves when prepared for self use while the commercial producers buy the raw materials from different sources and the potency of such products are much doubtful. There is no institutional mechanism to standardize and regulate the production.

The panchagavya is now being prepared from the raw materials sourced from exotic cows. I have come across many instances that the potency of the Panchagavya is the best when the raw ingredients are sourced from *Desi* cows.

a. The colour of the cow also matters as indicated in our ancient texts as belowand as informed by Mr.Saravana Guru, Nattasreeswaran Temple, Erode, TN:

Sl.No	Colour of the cow	Raw Material	Associated Rhishis	Sanskrit version
01	Black	Milk	*Bharathwajar*	*Krishna go sheerum*
02	White	Curd	*Gowsigar*	*Shitha go thathi*
03.	Grey (Smoke colour)	Ghee	*Kasyapar*	*Thumru go grithm*
04	Light brown colour)	Urine	*Gowthamar*	*Kapali go jalam*
05	Red	Dung	*Athri*	*Raktha go mayam*

b. Further, I have met and discussed with sages of this land who has knowledge about Panchagavya and understand that there are two different versions of Panchagavya possible. One is for prevention of ailments and ward of evils (Samkara Gramam) and the other is for creative purposes (Sristi gramam) to promote growth and development. The former one is prepared with one unit of dung + ½ the unit of Urine+ ¼ of Ghee + 1/8th of Curd + 1/16th of milk. The latter one is prepared with one Unit of milk + ½ unit of curd+ ¼ unit of ghee + 1/8 unit of urine + 1/16 of dung.

c. As per sage Parasarar the composition is given below:

01. Urine from black cow (Signifying Varunan)

02. Dung from white cow (Signifying Fire)

03. Milk from bronze colour cow (Signifying Moon)

04. Curd from red cow (Signifying Vayu)

05. Ghee from light brown cow (Signifying Sun)

Or all items can be obtained from Kapilai (light brown) colour cow.

One unit (palam) of urine, half thumb size dung, seven unit of milk, three unit of curd, one unit of ghee and one unit of water immersed with dharpa grass make potent ***Panchagavya or Brhmakoorcham. There are manthras to be chanted when handling the individual items, incorporation and preparation of Panchagavyam***

d. Sage Prajapathi suggests other method as below:

One unit of dung, two units of urine, four units of ghee, eight units of milk, five units of curd.

Even among the desi cows, there are cows with sixteen special attributes and natural markings on the body to indicate the sacredness of the cow. There is a message that the grithm prepared out of the milk from the fifth teat (rare occurrence) of a cow cures the ailments like cancer. There is a book in Devanagari language with tamil translation which deals with curative use of Panchagavya both for physical and para physical (psychic) violations by human in day to day life. There are mentions about different versions of Panchagavya for different purposes.

Different systems of organic agriculture have been promoted among the farmers with preparations using the Panchagavya ingredients either alone or in different combinations with different brand names but one should be cautious that nothing like the Panchagavya made by themselves for own use.

I trust that the information presented in the booklet shall be of much use for the farming community of India. Thanks to Tamil Nadu Agricultural University for scientifically validating the Panchagavya and released it as a technology and commercialized the production by authorizing the trade firms for mass

production of Panchagavya and use in agriculture. Government of Tamil nadu has created a new Development Department ' Department of Organic Certification, accredited by APEDA to promote organic agriculture and Panchagavya is gaining a stronghold in Indian Agriculture. There are exclusive shops at various cities to sell many products made out of the five elements of the cow as cosmetic items and are being admired by the public after their personal experience.

E.Vadivel 8th April, 2011

The Theory and Practice of Panchagavya

Introduction

Ancient wisdom is a treasure house of knowledge systems to safeguard the health and well-being of mankind, animals and plants. Vrikshayurveda is one such knowledge system, advocating crop culture with the use of natural inputs. It promotes a system which synchronizes all agricultural operations with natural forces emanating out of the Panchabhootas, viz. Earth (Geogen units), Water (Fluogen units), Air (Airogen Units), Fire (Pyrogen Units) and Space (Unit free entity). When mankind, animals and plants were living in perfect harmony, everything was wholesome and no remedial, correctional and improvement measures were required and there existed no ailments. Consequent to the domination and exploitation of flora and fauna by mankind and deviation from a natural life-style, problems cropped up due to forced imbalances in the above mentioned natural elements and the immediate casualty was the health and well-being of mankind, animals and crops. Agriculture as way of life, was no exception. Thus, health of soil, plant, micro and macro organisms as well as mankind has deteriorated over time; chemical agriculture has worsened the scenario and health hazards have increased exponentially.

Back to Life Natural

Mansanobu Fukuoka, author of the **One straw Revolution**, was one of the first to voice concerns across the world and sensitize the

minds of thoughtful scholars on the significance of natural living and cultivation of crops. Rachel Carson, the author of **Silent Spring**, created a powerful wave against the invasion of chemicals into agriculture, the environment and human body.

Notwithstanding such voices of grave concern, chemical agriculture continued over the decades to poison the land, water and air because of excessive use of fertilisers and pesticides over and above the recommendation. As a result, many crop laboratories of the world, reputed international Naturalists and NGOs extended their support to organic farming so as to create an awareness about abuse of chemicals in agriculture. A Green Movement, which championed the cause of organic agriculture during the late eighties, arose in the West. International Federation for Organic Agricultural Movement (IFOAM) established a certification process for the production of toxin free food for the humanity.

Theories, concepts and certification systems of organic agriculture were developed for each of the importing country and popularized under different names, viz. organic agriculture, green culture, natural farming, do-nothing farming etc. The enlightened public started demanding toxin –free food products. The market demand for organic produce gave further momentum to the organic movement, and eventually sporadic attempts have been made to detoxify the land, dispense with chemical fertilizers, pesticides, fungicides and herbicides, and grow crops organically. There was no organic substitute for these chemicals to begin with, yet the cause of organic agriculture picked up momentum.

Organic manure replaced chemical fertilizers, herbal extracts replaced pesticides and fungicides, but nothing was available to replace the growth promoting hormones and immunity boosters for the plants which could prevent yield loss when the system is converted to organic from inorganic. The organic system was imperfect and continued to be incomplete for want of an input to replace growth promoting hormones and immunity boosters, to maximize the efficiency of cultivated crops and coordinate the process leading to sustained higher productivity.

Panchagavya (or Bramha koorcham)

Indian knowledge systems have the answer to many problems of humanity. Our forefathers had propounded and practiced those systems directed towards attainment of a healthy body and sound mind. But humanity was lured by chemical technology and abandoned the ancient wisdom generated during the past. Vrikshayurveda is a treasure trove of information on crop culture and as such could lend support to organic agriculture. Panchagavya has been one such piece of wisdom, meant to safeguard all the human beings, animals, plants and microorganisms that dwell on the earth's surface.

Panchagavya is a bio promoter with a combination of five products obtained from the cow, which includes cow dung, cow's urine, milk, curd and ghee. All the five products are individually called "gavya" and collectively termed as "panchagavya". Panchagavya has the potential to play the role of promoting growth and providing immunity in plant system. The Panchagavya acts as growth promoter (75%) and immunity booster (25%) and exactly fills the missing link to sustain the organic farming with out any yield loss. It plays an important role in providing resistance to diseases, pests and in increasing the overall yield due to the immunostimulant activity of the cow's urine and growth promotion property of the cow dung and it can be prepared by the farmers themselves with the materials available on the farm. It was prepared by a slightly modified method as mentioned in *Vrksayurveda* and it was standardized by innovative practical farmers.

Mythology

Panchagavya consists of five products from the cow: dung, urine, milk, curd and ghee. When suitably mixed and used, these have miraculous effects. Panchagavya is prepared and used when performing rituals for ancesters at a particular lunar phase; when the person or the house is to be purified after the death of someone in the family; when a housewarming ceremony is performed in a new house to ward off evil forces; on the day a young priest is administered the Gayatri Mantra with

the sacred thread; and on Maha Sivarathri day, the day of Lord Siva. There are few quotes:

Kd;g[nghy; Kjy;tdhiu mKJ bra;tpf;f \Sk;
md;g[nghy; J}a bre;bey; mhprp khtLbkd;fPiu
Jd;g[nghk; kdj;Jj; bjhz;lh; Tilapy; Rke;J nghfg;
gpd;g[nghk; kidtpah; **Md;bgw;w m";nre;jpj;** brd;whh;
- bghpag[uhzk;

Cdpy; nka Mtp eP/ cwf;fhkhL czh;r;rp eP
Mtpd; nka le;Jk; eP/ mtw;Ws; epd;w J}a;ik eP
thdpbdhL kz;qk; eP/ tsk; fly; aht[k; eP
ahDk; eP/ mjdpd;wp vk;gpuhDk; eP/ ,uhknd
- ehshapu jpt;a gpuge;jk; 845
jpUr;re;j tpUj;jk; 94

g{tpDf; fU';fyk; bgh';F jhkiu
MtpDf; fU';fyk; mid; ma;e;jhl;Ljy;
nfhtpYf; fU';fyk; nfhl;lKkpd;ik
ehtpDf; fU';fyk; ekr;rpthant
- ekr;rptha jpUg;gjpfk;
eht[f;furh;/ ehyhe;jpUKiw

All these verses give an impression that Panchagavya is used to establish a link between living and dead, seen and unseen, physical and para physical, and earthly and heavenly forces. Such a high esteem and status for a simple product from a common animal many sound paradoxical, but when the truth is unraveled, one is overcome with wonder.

Earthly beings are made up of five basic-elements, viz. Earth (body dry matter), Water (90 percent of the body is water), Fire (98.4 degree celcious), Air (oxygen to every cell) and Space, which are at non-equilibrium within each of them and also among them. This is the reason for the existence of beings with all kinds of inequalities. Indian wisdom says that these basic units are almost at equilibrium in the cells of a cow, that is why the cow has been accepted as near divine in Indian

culture, and worshipped as Goddess from time immemorial. It is called Kamadhenu, the giver of all richness to humanity.

The farmers used to perform worship to a cow after decorating the head and face of the cow while a particular community to whom the money lending was way of life in down south of the TN, worships the cow at the back and at the time of the house warming ceremony, the cow is to brought into the newly built house with its back facing the house believing that the Goddess of Prosperity (Laksmi) and Goddess of Wisdom (Saraswathi) dwell in the urine and the dung respectively.

According to ancient texts, all the beneficent forces like gods, devas, sages, yogis and divine spirits are said to dwell in the body of the cow. The products from the cow have the ability to bring in the flow of cosmic energy, whenever and in whatever from they are used. Cosmic energy, even a speck of it, when made to pass through a living system, transforms the living being to wholesomeness, removing the imbalances in its physical, chemical, biological and physiological aspects and harmonizes the basic elements which results in revitalization of the growth process.

At the famous temple Srirangam where the deity Swami Ranganatha is worshipped , the daily practice (during the visvaroopa dharsan by 5.00 AM) is to bring a cow, allow it to turn its back to the God and stand ; When the pooja is performed , the screen is removed at the entrance so that the God could see the back of the cow where Goddess Laksmi is supposed to dwell.

The hump and horn signify the local breeds. Hump is said to be sensitive to cosmic vibrations while horn prevents the vibration of any kind from anywhere. Both regulates the inflow and out flow of cosmic forces in cows. Cows and bulls kneel down if their hump is gripped with hand. In castrated bulls, the hump is small while in un-castrated bulls, the hump is usually luxurious with dark shining hairs. There must be a link between vitality and hump in animals.

Physiochemical properties of panchagavya revealed that they posses almost all the major macro and micro nutrients and growth

hormones (IAA and GA) required for crop growth. Major nutrients like nitrogen, phosphorus, potassium, sodium, calcium, total sugars, reducing sugars, phenol, IAA, GA etc are present in Panchagavya which helps in enhancing the growth and yield of crops.

Chemical Composition

The low pH of the medium was due to the production of organic acids, by the fermentive microbes as evidenced by the population dynamics and organic acid detection in GC analysis.

Bio Chemistry

Predominance of fermentative microorganisms like yeast and *Lactobacillus* might be due to the combined effect of low pH, milk products, and addition of jaggery / sugarcane cane juice as substrate for their growth. *Lactobacillus* produces various beneficial metabolites such as organic acids, hydrogen peroxide and antibiotics which are effective against other pathogenic microorganisms besides its growth promotion effect for animals and human being as probiotics. GC-MS analysis resulted in following compounds of fatty acids, alkanes, alconol and alcohols.

Properties	Composition	Methods and Author
Total N (ppm)	382	Microkjeldahl – Humphries (1956)
Total P (ppm)	238	Triple acid digestion (colorimetry) – Jackson (1973)
Total K (ppm)	356	Triple acid digestion (flame photometry) – Jackson (1973)
Total sugars (ppm)	205	Nelson somogyis hydrolysis- Somogyi (1952)
Reducing sugars (ppm)	92	
Glucose (mg/dl)	6.0	Glucose oxidase- Malick and Singh (1980)
Total Na (ppm)	92	Triple acid digestion (flame photometry) – Jackson (1973)
Total organic carbon (%)	0.80	Chromic acid wet digestion – Walkey and Black (1934)
IAA (ppm)	9.15	Colorimetry
GA (ppm)	4.0	
Bacteria (CFU/ml)	24×10^6	Nutrient agar medium – Collings and Lyne (1968)
Fungi (CFU/ml)	1×10^3	Martins rose Bengal agar medium – Martin (1950)
Actinomycetes (CFU/ml)	3×10^3	Ken knights medium- Ken Knight and Muncie (1939)
Pseudomonas (CFU/ml)	45×10^3	Kings B medium

Yeast (CFU/ml)	35 x 10^4	Saborauds agar medium
Lactic acid bacteria (CFU/ml)	18 x 10^5	MRS agar
Methylotrophs (CFU/ml)	5 x 10^3	Ammonium mineral salt medium with methanol
Azospirillum (CFU/ml)	2 x 10^2	Nitrogen free malate medium
Acetobacter (CFU/ml)	43 x 10^3	LG medium
Ammonium oxidizes (CFU/ml)	24 x 10^5	Kings B medium
Nitrite oxidizes (CFU/ml)	2 x 10^2	
pH	5.12	Glass electrode - Jackson (1973)
EC (dSm^{-1})	9.9	
Zn (ppm)	0.26	DTPA extractant (AAS)- Lindsay and Norvell (1978)
Fe (ppm)	0.83	
Mn (ppm)	0.23	
Cu (ppm)	0.20	
Calcium (ppm)	32.0-37.0	
TSS (ppm)	85-115	
Magnesium (ppm)	15-24	
Phenol (mg/g)	0.75	
Lacto basillus (10^6/ml)	20-22.0	
Unaerobic microbes (10^5/ml)	9-11.50	

Fatty acids	**Alkanes**	**Alconol & alcohols**
1. Oleic acid	Decane	Heptanol
2. Palmitic acid	Octane	Tetracosanol
3. Myristic	Heptane	Hexadecanol
4. Deconore	Hexadecane	Octadeconol
5. Deconoic	Oridecane	Methanol, Propanol, Butanol & Ethanol
6. Octanoic	Eicosine	
7. Hexanoic		
8. Octadeconoic		
9. Tetradeconoic		
10. Acetic, propionic, butyric, caproic and valeric acids		

Possible correlation of the above compounds with plant metabolism

Hexanal : Short chain aldehydes such as hexanal and their derivatives are formed from lipids through sequential actions of lipid hydrolyzing, lipoxygenase and fatty acid hydroperoxidase lyase activities. They are reported to have to bactericidal and fungicidal activities. Aldehydes also induce defense response against herbivores.

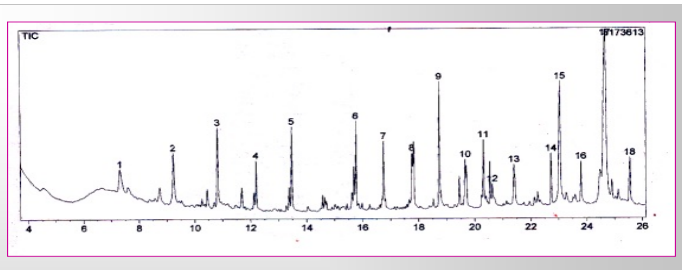
Compounds in oxylipin pathway : The Jasmonates, (epoxy and hydroxy fatty acids, divinyl ether fatty acids and short chain aldehydes) are involved in hypersensitive resistance response of plants infected by pathogens.

Dodecanoic acid :a crystalline fatty acid found as glycerides in many vegetable oils used in insecticide production.

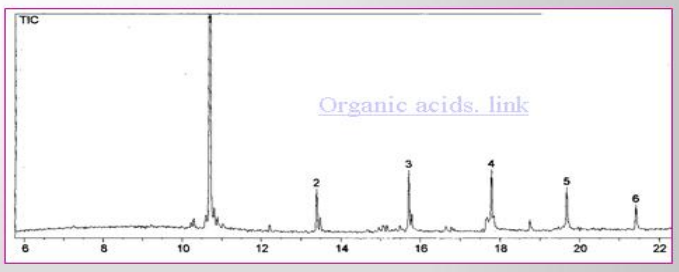
Oleic acid: A plant metabolic compound helps embryo development (seed development / seed filling).

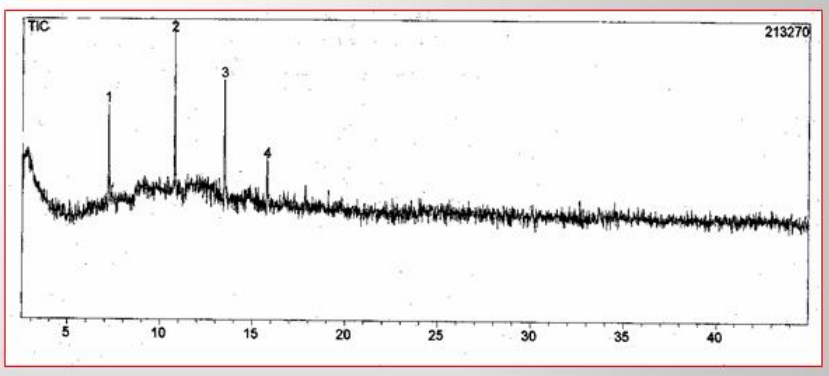
Myristic acid : They functions in signal transduction pathways and vesicular trafficking and also plays role in cell elongation.

Octadecanoic acid : They are mainly involved in activation of defense genes in tomato plants, seed development and seed filling. These compounds also show defense response against herbivorous insects and mites. Panchagavya is also known to contain growth-promoting substances such as IAA, GA and aromatic compound like phenyl acetic acid and benzoic acid. Such aromatic compounds are detected in panchagavya as metabolic products of both aerobic and anaerobic microorganisms. These products have definite role on the plant metabolism. Several isoprene compounds of microbial origin and unidentified components also associated with this product.

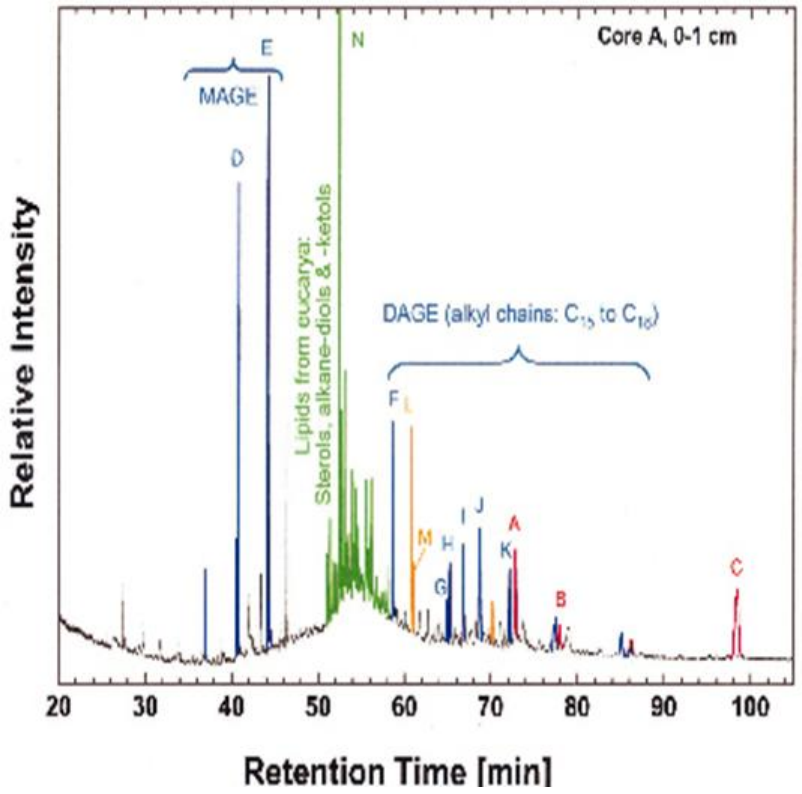


1. DECANE
2. DODECANE
3. PENTADECANE CONTAMINANT
4. ORIDECANE
5. HEXADECANE
6. HEPTADECANE
7. DODOCANAMIDE
8. 5-EICOSENE
9. 2-BUTANONE
10. 1-TETRACOSANOL
11. OXACYCOTETRADECANE
12. OCTADECONOIC ACID
13. 1-HEXADECANOL
14. 1,2-BENZENEDICARBOXYLIC ACID-
15. OCTANE, N-OCTYL ETHER
16. PENTACOSANE
17. PROPANOIC ACID
18. OCTACOSINE





1. 3, HEXANONE,2,2 DIMETHYL
2. HEPTANE 2,3,4 TRIMETHYL
3. 1-CHLORO-HEXADECANE
4. 1-12-HYDROXYETHOXY TRIDECANE



Science of components of Panchagavya

Cow dung

Japan uses cow dung to get protection from atomic emissions. CISH identified few actinomycetes, which are helpful in control of many plant diseases like gummosis, die back and anthracnose and the cow dung has been a regular component for plastering houses in the Indian villages.

Nutrient content

The cow dung (Gomay) was found to have undigested fiber, epithelial cells, bile pigments and salts rich in nitrogen, phosphorus, potassium, sulphur, micronutrients, intestinal bacteria, fungi and microbial organisms. It contain water 82 per cent and solid matter 18 per cent which constitutes minerals 0.1 per cent, ash 2.4 per cent, organic manure 14.6 per cent, Ca and Mg 0.4 per cent, SO_3 0.05 per cent, Silica 1.5 per cent, N 0.5 per cent ,P 0.2 per cent and K 0.5 per cent (Singh, 1996).

The N, P and K content of cow dung were 0.3-0.4 per cent, 0.1-0.2 per cent and 0.1-0.3 per cent respectively and of cow's urine was 0.9-1.2 per cent, trace and 0.5-1.0 per cent respectively (Patnaik, 1997). Although, the proper estimates of the nutrient contents of other constituents of panchagavya are not available, carbohydrate, calcium, iron and phosphorous compositions have been given by Sharma (1998).

Cow Urine

Urine of cow is bitter, pungent, piquant, spicy, warm and full of all the five types of elixirs. It is very pious, anti poisonous, insecticidal, regulator for all the three disorders like gas, acid and cough. It has been experimentally proved that among all sorts of urines, the urine of the Indian cow is most effective. The urine of Indian cow is pious as the water of Ganges at Gangotri. Thus it is a universal medicine for mankind and is used in curing many diseases associated with humans. The urine of the cow works as best appetizer, cleans the intestines, cures blood disorders, asthma, and diarrhea and subsides diseases pertaining to ears.

The root cause of various diseases in man is the shortage or excessive of the elements which are already in the body. The urine of the cow, contains all such elements in it. Hence, it is a natural and universal medicine to fulfill the shortage of elements or to equalize and reduce the increased elements in the body and it is the quality of the urine which helps in curing even the most incurable diseases:

- acts a plasma ultra filtrate
- as anti-convulsing property
- has known healing agents
- has melatonin and muranyl dipeptide hormones to regulate sleep and calming effect

- Has 'Urea' which possesses antibacterial, antifungal and antiviral properties by causing osmotic imbalance on pathogens.
- Has been used in the preparation of cosmetic soaps.

Cow dung and urine in combination(1:1) produces urinary carbonate. As the urease enzyme in the dung breaks down urinary urea and traps CO_2, urinary carbonate is formed which in turn kills the pathogenic organisms such as *E. coli, Salmonella, Streptococcus pyogenes, Klebsiella pneumoniae* and *Staphylococcus aureus*. Cow urine concoction (CUC) is a popular herbal preparation containing cow urine. Its major pharmacological actions include anticonvulsant and hypoglycemic effects.

- Cow urine contains copper, which transforms into gold in human body. Gold has power to destroy all diseases and is an antidote.
- Besides, copper, cow urine contains, iron, calcium, phosphorus, carbonic acid, potash and lactase.
- It contains 24 types of salts and the medicines made from cow urine are used to cure several diseases.

Cow urine is disinfectant and prophylactic and it purifies and improves the fertility of land. (Nirmal De and K.P.Singh, 2003).

Nutrient Content

Cow's urine contains uric acid and hippuric acid in large quantities along with minerals like sodium, chloride, sulphates of calcium and magnesium, potassium hippurate etc. (Singh,1996).

Reddy (1998) revealed that cow's urine (Gomootra) is a rich source of urea and acts as a nutrient as well as a hormone. It contains 91 per cent water +19 per cent solid matter which includes 1.4 per cent minerals, 2.0 per cent ash, 6 per cent organic manure, 0.15 per cent Ca and Mg, 0.15 per cent SO_3, 0.01 per cent silica, 1.0 per cent N, traces of P and 1.35 per cent K. Urine contains most of the N (63 %), K (95 %) and S (50 %), wastes which are readily soluble. The loss of nitrogen takes place from urine as ammonia (Sharma, 1998).

US patent was granted to Indian scientists on the use of cow urine distillate as bio enhancer. It was found that the cow urine distillate in an effective amount could enhance the antimicrobial effect of the antibiotic disclosed on pharmaceutical composition (*www.govigyan.com*, 2002)

Cow Milk

Milk of cow possesses excellent qualities. Milk proteins display superior biological value than vegetable proteins. Major proteins of milk are Caesin and Whey proteins which complement each other in the quantitative distribution of aminoacids.

Casein performs the role of mineral (calcium and phosphate) carrier while whey proteins offer protection against tumour incidence and enhance numerous immune responses. The immunoglobulin in milk is also important fro imparting immune defense to the host. Bioactive peptidase arising from casein as well as whey proteins has antihypertensive and anti-thrombotic properties. Immunopeptides are immunostimualnts and phosphopeptidies are mineral carriers. The principal carbohydrate of milk is lactose and it facilitates the absorption of Ca, Mg and Mn. Lactose promotes the growth of lactic acid bacteria.

Nutritive content

In history Varahamihira (Brahat Samhita 505 -587 AD) had explained the special practice of soaking the seeds in milk for 10 days. The seeds were taken out daily and smeared with ghee and rolled many times in cow dung before sowing. They performed well in soil when sprinkled with a combination of milk and water (Deshpande and Menon, 1995).

Nene (1999) reported cow's milk to be an excellent sticker and spreader. It acts as a good medium for saprophytic bacteria and virus inhibition. Linda Mc Graw (1999) stated that the nutrients in milk are protein, fat, carbohydrates, amino acids, calcium, hydrogen, lactic acid and *Lactobacillus bacterium*. This bacterium is capable of fermenting both five and six carbon sugars. Vrkshayurveda described the use of

milk in changing the flower colour and in enhancing the fruit taste (Shenoy *et al.*, 2000).

Cow's curd

Curd provides the vital nutrients of milk as well as metabolic products of fermentation. Lactic acid present in curd penetrates into the bacterial cell wall of *Salmonella enteritidis* and *E. coli* thereby inhibiting their growth. Viable lactobacillus organism can deconjugate bile salts in the intestine and thus suppresses food borne pathogens. Further organic acids like acidic propionic acid and lactic acid can cause antibiosis. Also curd has immunomodulating effect.

LAB (lactic acid bacteria) produce bacteriocions like acidophilin, lactacin, lactolin, bacteriocins with significant bactericidal effect against food borne pathogens. Fermented milk suppresses the onset of carcinogenesis. Viable LAB may reduce the chances of colon cancer in human. It is a rich source of the microorganisms like *Lactobacillus* that are responsible for fermentation (Manilal Chandha, 1996).

Cow Ghee

Milk fat (ghee) is having a positive role after consumption. Free fatty acids and monoglycerides generated during digestion exert surface tension lowering effects, thereby providing protection from bacterial infections.

Conjugated linoleic acids (CLA) are a class of fatty acids found in milk and ghee. These are strong anti-oxidant constituents of milk fat and may prevent colon and breast cancer in human (Aneeja et al., 2002). CLA reduces the risk of heart diseases, increase bone density, reduce chronic inflammation and normalize blood glucose levels. CLA is not only a powerful anticarcinogen but also has anti atherogenic, immunomodulating, growth promoting, lean body mass enhancing properties. (Parizia, 1997). Another compound probiotics are based on non or slowly absorbable complex carbohydrates that can be assimilated by beneficial bacterial such as Bifidobacterium and Lactobacillus spp.

Examples of probiotic substances are inulin, lactulose, various galacto, fructo, xylo, oligosaccharides and sugar alcohols such as lactitol and xylitol (Salminen et al., 1998).

Butyric acid liberated from milk fat by lipase exerts beneficial trophic effect on the gastric and intestinal mucosa cells and confers anti-cancer properties. Ghee possesses healing properties that many oils just can't boast. The ability of ghee to support physical and mental renewal has been substantiated by science.

Cow's ghee exhibits:

- antichollestric activity
- memory enhancing activity
- immunostimulant activity

In ayurveda, ghee is highly regarded as a medicine and sattvic (balanced) food. It is also used to promote memory and mental alertness, good digestion and healthy skin. Ghee contains an ideal, balanced ratio of fatty acids and contains no trans-fatty acids which are associated with heart diseases. Ghee has no oxidized cholesterol.

Ghee acts as a vital carrier of medicines to the tissues of the body, it has long been used as a base for herbal remedies. In this way, the medicine penetrates deep into tissue layers causing absorption. Ghee contains butyric acid, a fatty acid that has anti-viral and anti-cancer properties.

Nutritive content

Cow's ghee had been used in ancient and medieval times (Kautilya 321-296 BC and Someshwara Deve 1126-AD) for managing seedling health which was reported by Nene (1999). Ghee was reported to contain vitamin A, vitamin B, calcium, fat, etc, and also rich in glycosides which protected the wounded portion from infection.

Additives

Coconut water acts as the best and cheapest substitute for kinetin which increases the chlorophyll content (Thangaraj and Sivasubramanian, 1992) and used as additive in panchagavya.

The mineral contents (mg per 100 gm) of jaggerry, milk, curd and ghee are 0.6, 0.8, 0.8 and 2.5 respectively. The carbohydrate content is 9.5, 4.4, 3.0 and trace. The calcium, iron and phosphorous contents (mg per 100g) in these four components are 80, 120, 149 and trace (Ca) 11.4, 6.02, 0.2 and trace (Fe) and 40, 90, 93 and trace (P) respectively (Sharma, 1998). Sugarcane juice, a substitute in panchagavya facilitates easy fermentation by attracting microbes (Nene, 1999).

The Rural Community Action Centre, Kodumudi, Tamil Nadu conducted an experiment by adding fifteen organic materials to normal panchagavya and reported that tender coconut water, sugarcane juice and banana fruits added the potency of panchagavya by enriching its organic property (Natarajan, 2002).

Panchagavya as Plant Growth promoter

Panchagavya on vegetative phase

The morphological characters like plant height, number of laterals, number of leaves, flowering and fruiting characters influence the growth and productivity of a crop. These morphological parameters were differentially manipulated by panchagavya, which contribute to the growth and quality of the crop.

The panchagavya treated plants was found to accord the highest plant height and a manifold increase in plant height was noticed with increase in panchagavya concentration. Panchagavya is the fermented organic manure with high microbial load which includes Effective Micro Organisms (EMO) and Methylotrophs Profile Bacteria (MPB) also. These EMO in panchagavya would have enhanced the production of phyto hormones like auxins and gibberellins that might have stimulated the growth by increasing the plant height as evidenced from the work of Xu *et al.* (2000).Apart from this, Methylotrophs profile bacteria are known to produce cytokinin and auxin (Iyanova *et al.,* 2001), which was found to

be a part in panchagavya and play a major role in increasing the plant height as a growth promoter.

Above all, panchagavya constitutes cow dung, Cow's urine, milk, curd, ghee and jaggery. Patnaik (1997) and Sharma (1998) have provided the data of nutrient content in the constituents of panchagavya. Cow's urine contains most of the N (63%), which is responsible for the vegetative growth, followed by K (95%). Cow dung contains phosphorus and uric acid and thus contributes to better growth. In addition, nutrients in urine are in readily soluble form and it was stated that the liquid forms can be taken up by the plant quickly leading to early growth (Salatin, 1993). All these facts support to the growth enhanced by the effect of panchagavya.

The cow dung was used by Kautilya (321-296 BC), Varahamihara (505-587 AD), Surapala (1000 AD), Someshwara Deva (1126 AD) as reported by Nene (1999). The cow dung contains a mixture of nutrient contributing substances such as undigested fibre, epithelial cells, bile pigments of salts rich in N, P, K of micronutrients, intestinal bacteria, fungi and micro organisms (Singh, 1996), which contributes to effective plant growth. The cow's urine is rich in uric acid and hippuric acid along with growth stimulating minerals like sodium, chloride, sulphates of calcium and magnesium (Singh, 1996). The rich source of urea present in cow's urine act as a nutrient as well as a hormone (Reddy, 1998). An indigenous practice of sprinkling cow's urine on plants and other vegetables at the flowering stage was adopted for promoting growth.

Cow's milk was reported to be an excellent sticker and spreader (Nene, 1999). As a result, it acts as a good medium for saprophytic bacteria and virus inhibitors. Thus, an ancient practice of spraying milk on vegetables prevailed to prevent virus diseases. This milk spray forms a sticky layer on the surface of leaf and trap insects such as whiteflies and thrips which act as vectors of plant diseases. Thus, it promotes healthy growth. Apart form this, milk also contains an important bacterium *Lactobacillus bacterium*, which is capable of fermenting both five and six carbon sugars and enables the availability of carbohydrates

in abundance to the plant resulting in vigorous plant growth (Linda Mc Graw, 1999).

The ghee was reported to be a rich source of glycosides, which protects the cut portion from infection (Nene, 1999) and contributes to healthy growth. The jaggery, added as an additive in panchagavya, attracts microbes and facilitates easy fermentation by nourishing the microbes with its nutrient content. All the above properties of panchagavya would have contributed for the excessive growth compared to other treatments.

The cow dung and cow's urine constitute the major part of N in panchagavya which leads to formation of protoplasm, cell division and cell enlargement complementing to vigorous growth. Since nitrogen is the chief constituent of biologically important amino acids, and co-enzymes (Bakly, 1974), panchagavya was found to promote growth with these biologically reactive actions.

In the case of laterals, an enhanced release of nitrogen from the growth promoting substances produced by the microbes present in panchagavya might have resulted in the induction of laterals. More number of laterals was produced by the panchagavya treatments, which might be due to the fact that adequate quantity of enzyme present in cells favors rapid growth. The nitrogen content in cells due to natural panchagavya spray would have contributed to the build up of protoplasm for the formation of enzymes needed for rapid growth. This view was supported by the findings of Bakly (1974).

Above all, the organic acids produced during the fermentation of panchagavya mixture inhibit IAA oxidase enzymes and thus, paves way for the promotive effect of auxin –IAA, which directly influences the growth (Leopauld, 1974). When the auxins are more, the plants are able to absorb and translocate the nutrients to the apical bud resulting in pronounced growth. Similarly when the auxin levels are higher, the availability of differentiating hormones like cytokinin will be less leading to the increase of vascular connections promoting lateral branches.

The quantity of IAA and GA present in panchagavya at continuous spray will create a stimulus in the plant system. This in turn will activate the entire cell system leading to effective functioning with further natural production of more bioactive growth regulating substances.

Macro (N, P, K, Ca and Mg) and micro (Zn, Fe, Cu and Mn) nutrients along with total reducing (glucose) sugars were observed in panchagavya. The combined effect of nitrogen with carbohydrate led to the formation of complex nitrogenous substances such as protein, amino acid and amides which help in building up the *de nova* tissues by increasing the meristematic activities. This mechanism in panchagavya might have contributed to the increased number of laterals.

The natural organic mixture, panchagavya, greatly influences the colour and nutrient content of leaves. For example sprayed on chillies produced dark green colour in leaves and the emergence of new growth was within ten days of spray (Subhashinisridhar *et al.* 2001). The chemolitho autotrophic nitrifiers, identified in panchagavya, were found to be colonized in leaves and contributed to vegetative growth directly and indirectly by increasing the ammonia uptake and thus, enhancing the total N supply (Papen *et al.* 2002) leading to increased number of leaves in plants.

Similarly, the dry matter production, which is an important trait in deciding the productivity of a crop, was superior in panchagavya treatments. The high organic matter content, presence of numerous active enzymes, vitamins, macro and micro nutrients in panchagavya might have contributed to the increased dry matter production. The interaction of nitrogen and glucose in panchagavya might have contributed to the increased dry matter. Apart from this, the canopy spread and dry matter content are directly proportional to wider canopy spread resulting in greater fruiting area and increased dry matter. Thus panchagavya treated plants have higher number of laterals and leaves leading to wider canopy spread. The improved vegetative growth in panchagavya treatments, evidenced by the increases in plant height, number of laterals and leaves, shoot fresh and dry weight and canopy

spread, serves as an essential pre-requisite for dry matter content, thereby increasing the crop yield.

Panchagavya on reproductive phase

The measure of parameters like number of flowers, number of fruits and fruit yield are closely related with the growth and yield attributes. Flowering is an important criterion that governs the yield of a crop. Panchagavya hastened flowering resulting in maximum number of flowers and proved to be more efficacious than other treatments. Panchagavya, when sprayed on the foliage, facilitates instant uptake of nutrients (Sharma, 1970), which leads to the effective conversion of vegetative phase to flowering phase. Further, the enhanced vegetative growth coupled with adequate reserved food materials promotes easy differentiation of vegetative buds into flower buds leading to earliness in flowering. Similar advancement in phonological stages was reported by Renuka and Shankar (2001) in tomato, Beaulah (2001) in annual moringa and Somasundaram et al. (2003) in green gram.

Increase in the number of flowering shoots and earliness in flowering was noticed with the panchagavya treatments. This may be due to N, P and K contents of panchagavya as supported by Jayashankar et al. (2002). This study revealed that the panchagavya excelled well compared to other treatments by registering highest number of fruits and proved its concurrent influence. The enhancing effect of panchagavya in vegetative phase accompanied with highest number of flowers in reproductive phase positively contributed to the highest number of fruits per plant.

Similarly, the reproductive growth was also positively effected by panchagavya, resulting in earliness of a crop due to the cell differentiation and flower bud formation activity of the cytokinin present in panchagavya. This contributes to the endogenous cytokinin level and promotes the transition to flowering from vegetative stage.

Foliar spray of Panchagavya on chillies produced dark green coloured leaves and new growth within 10 days (Subhashinisridhar *et al.,*

2001). In rose cultivars like Edouard (*Rosa bourboniana* Desp.) and Red rose (*Rosa centifolia* L), a treatment of calcium acetate 0.5 % + Panchagavya 5 % proved to be effective in improving the height of the bush (48.88 & 84.86 cm) in both the cultivars on 30th and 60th day after planting respectively (Thamaraiselvi, 2001).

The number of flowering panicles per tree and number of flowers per panicle were increased in moringa by the application of a combination of organic manures like poultry manure (500gm), neemcake (250 gm) and panchagavya 2 percent (Beaulah, 2001). A treatment of Panchagavya 5 % + calcium acetate 0.5 % was found to induce early flowering in 45.6 days and 53.31 days in cultivars Edouard (*Rosa bourboniana* Desp.) and Red rose (*Rosa centifolia* L) respectively (Thamaraiselvi, 2001). Jayashankar *et al*. (2002) reported that a foliar spray of 3 per cent panchagavya on field bean increased the flowering and fruiting substantially after a week period.

Panchagavya on Yield and biomass

Yield is a complicated phenomenon, which could be engineered both by morphological and physiological parameters. It can be manipulated by either genetic factors or cultural operations. The yield attributing characters such as root length, root diameter, number of root primaries, fresh and dry weight of roots and seed yield was found to be superior with panchagavya spray. This might be due to the ability of panchagavya to restore the yield level of all crops during the transitory period (Natarajan, 2002) which was reported to be its special feature. Since, the transitory period is characterized by the fall in productivity during the conversion of inorganic supply of nutrients to organic.

Further, the beneficial effect of panchagavya spray might be due to the cumulative effect of N and P along with enhanced synthesis and activity of growth promoting substances produced by the microbial load in the organics. This combinational reaction in Panchagavya leads to the ultimate goal of maximization of yield. The root characters, which serve as the economic part was important to prove the drought hardiness of a

crop and it should be as long and thick. The highest root length might have occurred in panchagavya treated plants because of its high microbial activity and its superiority in reducing the plant disease index and thus increasing the vigour of plant and yield. This view gains support from the findings of Reddy and Padmodaya (1996), who revealed that modified panchagavya 3 (MPG-3) suppresses the pathogen by encouraging the local antagonists of the pathogen leading to increased vigour in tomato, resulting in increased root length and maximum dry weight, which paves way for heavy yield. This might be due to the increased translocation of stored carbohydrates and amino acids contributed by the nutrients of panchagavya and other metabolites to the major storage organs of the plant, where these were utilized for the formation of secondary metabolites.

The same trend was noticed for other root characters like root diameter and root volume. The root volume includes the number of root primaries which serve as an indicator for the plant capacity to absorb water and nutrients. Hence, more number of primaries in roots was considered to be the desirable trait which was produced by panchagavya spray. The panchagavya treatment was found to produce effective root system to meet the requirements of the wider canopy production. This effect can be related to the effect of cosmic energy in panchagavya which eliminates the imbalance in the living system by restricting the unwanted apical growth and thereby increasing the share of hormone to the root system and assimilates for its extension of growth and promotes drought hardiness.

Superior effects of panchagavya on root yield and seed yield might be due to the accumulation of more photosynthates as a result of more number of laterals and leaves which increase the photosynthetic rate. This enhances the root growth, which acts as the sink for the photosynthates resulting in higher yield. This was supported by the experience of Natarajan (2002) who reported that bigger leaves were produced as a result of panchagavya spray.

The increased increments of DMP and leaf area index develop a better sink relationship. This enabled greater synthesis and translocation of metabolites to the reproductive organs leading to improved seed yield. Panchagavya was remarked to produce positive influence on the growth, yield and quality attributes with the growth promoting substances which led to a two fold increase in the yield and thus, created a positive effect on the root shoot ratio and harvest index.

Above all, the promising and superior yield produced by panchagavya might be due to the synergistic effect of panchagavya when used as a foliar spray to the crop as tested by Natarajan (2002). The nutrients N, P and K when applied at optimum quantities cause rapid plant growth and yield (Cuteliffe *et al.,* 1968). This report supports the synergistic and complementary effect of the Gavya's after fermentation which contributes the above nutrition and favours the highest yield in panchagavya treatments.

Reddy and Padmodaya (1996) reported that application of modified form of panchagavya three per cent along with neemcake 250 gm per square meter in tomato recorded maximum shoot and root length and maximum dry weight along with high fruit yield of 16.7 tons per hectare over control (14.1 tons per hectare) inferred that a three per cent spray of panchagavya on turmeric on 70, 120 and 150th day of planting produced one-third increase in length of rhizomes with a high yield of 33 quintals per acre. Vivekanandan (1999a) observed that a spray of per cent per cent was effective in enhancing the growth and yield of rice and panchagavya sprayed at 25 DAS and 40 DAS advanced the paddy harvest by 10 days.

Gomathinayagam (2001) carried out an experiment by irrigating the kitchili samba, an indigenous rice variety with cow dung solution on 25 thday after transplanting and spraying with one per cent of cow's urine solution on 30th day after transplanting and three per cent spray of panchagavya on 40th day of transplanting. He deduced that a high yield of 1400 kg per acre was recorded and the crop was ready for harvest on

130th day after transplantation. Maha panchagavya was found to activate soil and to protect plants from diseases (Shenoy *et al.,* 2000).

Beaulah (2001) reported that in moringa, a treatment combination of panchagavya two per cent +poultry manure 500 gm +neem cake 250 gm + 150:150:75 gm of NPK per pit recorded the highest yield of 23.08 and 37.95 kg per tree in main and ratoon crops. Natarajan (2002) implied that a three per cent spray of panchagavya on Yazhpanam moringa before the end of flowering stage produced a yield of 1000 fruits perharvest. A five per cent spray of panchagavya on bacterial leaf blight affected paddy crop controlled the disease within one week of spray completely. A three per cent spray of panchagavya on chilli led to dark green fruits within 10 days of spraying. An increased yield was obtained in lemon when panchagavya three per cent was sprayed during the vegetative and flowering stage.

The special feature of panchagavya was its ability to restore the yield level of all crops during the transitory period (Natarajan, 2002), which is characterized by the fall in productivity while converting inorganic supply of nutrients to organic.

Somasundaram *et al* (2003) reported that three per cent panchagavya was the ideal concentration for foliar spray on green gram variety CO-4. He also predicted that foliar application of panchagavya at the rate of three per cent on 15, 25, 40 and 50 DAS with no inorganics was the effective low cost technology in terms of grain yield in the production of green gram. A treatment combination of panchagavya + vermicompost on French bean variety Ooty - 2 gave 36 per cent higher pod yield than conventional methods.

It has also been reported that application of FYM 25 tonnes, biodynamic compost five tonnes, neem cake five tonnes, *Azospirillum* and *Phosphobacteria* at the rate of two kg per hectare and foliar spraying of panchagavya three per cent at monthly intervals recorded the increased plant height, number of branches, number of leaves, leaf length and width in the case of thyme and rosemary. The yield, oil content and benefit cost ratio were high for the same treatment in both the crops.

Panchagavya on physiology of plants

A close relationship exists between the physiological attributes and yield factors. The physiological activity of the plant was measured in terms of leaf area index, chlorophyll content, chlorophyll fluorescence, relative water content and photosynthetic rate, which were found to be higher for the treatment panchagavya.

The action of the growth regulators in the plant system was checked by counter activity of inhibitors, and the stimulation of necessary growth substances was through external application as foliar spray, which increases the physiological activities of growth and development leading to better yield (Kalarani, 1991).

The maximum leaf area in panchagavya treated plants might be due to the leaf expansion facilitated by the growth regulators such as GA, IAA present in panchagavya, which favour cell elongation and better N assimilation (Somasundaram et al., 2003). As bigger leaves are produced by panchagavya spray (Natarajan, 2002), it leads to enhanced leaf area index. Thus, the small amount of GA in panchagavya might have increased the leaf area index contributing to the growth attributes.

The chlorophyll content was registered to be higher with regard to the treatment panchagavya. In general, the rate of increase in chlorophyll content was high in vegetative stage than in maturity stage. This may be due to the enhanced absorption of nutrients leading to accumulation of more pigments in early stages and in later stages, and these nutrients are mobilized for the economic part development.

The maximum chlorophyll content in the leaves might be due to the diversion of adequate photosynthetic nutrients such as Fe and N to the site of photosynthesis for enhancing the chlorophyll content by the coupled effect of biofertilizer and growth promoters present in panchagavya. This favourable effect of panchagavya on chlorophyll content was reported by Beaulah (2001).

The presence of biofertilizers in panchagavya at commercial load was confirmed by Solaiappan (2002) which might influence the

chlorophyll content by it's nitrogen fixing ability and it's capacity to synthesize growth hormones like GA, cytokinin etc. Coconut water as, an additive in panchagavya, constitutes kinetin (cytokinin) which contributes to increased chlorophyll content

The highest chlorophyll fluorescence yield was registered under panchagavya treatments. In general, the fluorescence yield is higher when photochemistry and heat dissipation are lower. Hence, changes in photochemical efficiency and heat dissipation were correlated with the changes in fluorescence yield. Fluorescence might be due to the increased number of laterals and leaves, leading to maximum leaf area that favour higher level of photosynthesis indirectly, such as, primary light reactions, thylakoid electron transport reactions and dark enzymatic stoma reaction and thus inducing changes in photochemical efficiency, leading to increased fluorescence yield. This was also due to the cumulative effect of microbial load and biofertilizer in panchagavya (Solaiappan, 2002 and Xu and Xu, 2000).

Similarly, favourable effect on the photosynthetic rate was registered for the panchagavya treatment. The increased photosynthetic rate in panchagavya treatment might be due to the coconut water added as additive in panchagavaya which contain kinetin and it acts as a growth hormone and plays a major role in photosynthetic activity enhancement. (Kalarani and Jeyakumar, 1998). Similarly, the effective microorganisms in panchagavya might have produced bioactive substances, which significantly affected the leaf stomata response (to open for longer time and close more slowly) and thereby increasing the photosynthetic efficiency which in turn ultimately increased the yield (Xu and Xu, 2000). There was no chlorotic symptom in the plants treated with Panchagavya and was found to increase the source size for photosynthetic efficiency.

As the chlorophyll content was also higher in panchagavya treatment, it favoured higher photosynthetic rate along with the activating effect of microorganisms on enzymes (Iyanova *et al.,* 2001). The photosynthetic rate and nitrate reductase activity were directly

proportional and higher nitrate reductase activity confirmed better photosynthetic rate and thereby increased the physiological activity. The nitrate reductase activity contributes nitrate form of nitrogen, which is the important part of chlorophyll molecule.

The relative water content serves as an index for the water status of a plant. This parameter is positively associated with the tolerance level of a crop to water deficit. Highest relative water content registered in panchagavya may, facilitate retention of more amount of water in the leaf tissues which makes the plant more drought tolerant. Thus the cumulative effect of wider canopy and increased relative water content is the unique feature of panchagavya treatment.

The crop growth rate was observed to be higher under panchagavya with regard to other treatments. This effect may be due to the increased number of laterals, leaves, fruits, flowers accompanied by the growth promoting hormones in panchagavya. This reason was found to be correlated with the findings of Somasundaram et al., (2003). During the crop growth, the influence of nitrate reductase enzyme in the nitrogen assimilation process plays a key role in the metabolic regulation of nitrogen in crops. When this mechanism is influenced by growth regulators, it leads to increased net assimilation rate. Thus, the presence of growth promoting substances such as IAA and GA in panchagavaya might influence the uptake of more N leading to increased nitrate reductase activity, which effected the nitrogen assimilation and promoted protein synthesis leading to increased plant growth and development.

The physiological parameters like dry matter production, chlorophyll content of leaves were found to be the highest in the treatment combination of poultry manure + neem cake+ panchagavya along with increased dose of inorganic fertilizers.

Panchagavya on plant nutrient content

In the present study, highest leaf N, P and K contents were registered by the panchagavya treated plants. This might be due to the increased availability of all macro and micro nutrients in panchagavya.

The cumulative effect of wider canopy noticed in panchagavya treated plants along with promoting effect of growth regulators in panchagavya contributed to the increased leaf nutrient content.

The cow's urine rich in uric acid, a source of nitrogen (Singh, 1996) is readily soluble and the liquid form applied as foliar spray was readily available to the plants, and directly influence the nitrogen content of leaves (Salatin, 1993 and Sharma, 1970). Apart from this, the biofertilizer also serves as nitrogen contributor as panchagavya has a commercial load of biofertilizers (Solaiappan, 2002).

The nitrogen level triggered the vegetative growth which in turn favoured phosphorus absorption in order to maintain the nutrient balance in plant cell. The biofertilizer also plays a major role in making phosphorus available to plant by dephosphorilating the phosphorus bearing organic compounds. Hence, the biofertilizer content in panchagavya would have contributed for the increased leaf phosphorus.

The availability of nitrogen, enhanced by the biofertilizers in turn increased the potassium content in order to maintain the optimum balance of nutrients. The special feature of panchagavya is it eliminates the imbalances in physical, chemical and biological processes due to the cosmic energy produced by stirring the stock solution. The basic elements of growth are harmonized by this energy which refreshes the growth process (Sundararaman *et al.*, 2001).

Microbial load:

Fungi	38800/ml
Bacteria	1880000/ml
Lactobacillus	2260000/ml
Total anaerobes	10000/ml
Acid formers	360/ml
Methanogen	250/ml

The microorganisms like lactobacillus are responsible for fermentation. The EMO in panchagavya have enhanced the production of

phytohormones like auxins and gibberellins that stimulated the growth. Methylotrophs profile bacteria are known to produce cytokinin and auxin, which was found to be a part in panchagavya and play a major role as growth promoter. The fermentative microorganisms like yeast and lactobacillus are predominant in panchagavya due to the combined effect of low pH, milk products and addition of jaggery/ sugarcane juice, which act as substrate for their growth. Lactobacillus produces various beneficial metabolites such as organic acids, hydrogen per oxide and antibiotics which gives protection against other pathogenic microorganisms.

Panchagavya on Microbiological Consortia of soil

Effective micro organisms (EMO) are the mixed culture of naturally occurring, beneficial microbes (predominately lactic acid bacteria (*Lactobacillus*), yeast (*Saccharomyces*), actinomycetes (*Streptomyces*), photosynthetic bacteria (*Rhodopsuedomonas*) which were found to be present in panchagavya. Certain fungi (*Aspergillus*) improve the soil quality and growth and yield of sweet corn, which was equal to or higher than the effect of chemical fertilizers (Xu and Xu, 2000). Xu and Xu. (2000) reported that EMO cultures could synthesize phytohormones (i.e.) auxins and others growth regulators that stimulated maize plant growth and they contained proactive substances that could have significantly effected leaf stomatal response in maize. Leaf stomata of the EMO treated maize opened more rapidly than water treated control plants, and when the leaves were subjected to dehydration, the stomata closed more slowly (i.e., remained open longer). Thus, it showed that EMO contained bioactive substances that could have significantly affected the leaf stomatal response and led to increased LAI. Methylotrophs profile bacteria are known to produce cytokinin and auxin.

In Panchagavya, proven bio fertilizers such as *Azospirillum* (10^{10}), *Azotobacter* (10^{9}), *Phosphobacterium* (10^{7}) and *Pseudomonas* 10^{6} were found besides *Lactobacillus,* as reported by Solaiappan (2002). Ammonia and nitrite oxidizers were found to colonize the leaves which increased

the ammonia uptake and total nitrogen supply of spurce trees (Papen *et al.,*2002).The crude extract of *Pseudomonas* was found to enhance the growth of garden pea seeds, incubated with distilled water since it contained IAA and GA_3 (Mahalingam and Sheela, 2003).

Crop based Experiments

Moringa

An experiment was conducted to find out the efficacy of organic manures vix., FYM, poultry manure, neem cake, biofertilizers *viz.,* azospirillum, VAM and natural organic product panchagavya on the growth and yield of moringa. The treatment combinations of poultry manure + neem cake + panchagavya (2 % spray) out yielded other treatments for the growth and yield characters. Days to 50 % flowering was advanced to 14.93 days in the above treatment. The yield attributes *viz.,* number of pods/tree (225.57), pod weight (95.37g), pod yield (35.67 kg/tree) were the highest in the above treatment combination of poultry manure + neem cake + panchagavya.

The nutrient contents *viz.,* Carotene (144.97mg/100 g), ascorbic acid (131.53 mg/100 g) and soluble protein (5.74 g/100g) were found to be the highest in the same treatment combination of poultry manure+ neem cake + panchagavya.

It was found that the treatment combination of poultry manure+ neem cake + panchagavya was very effective in controlling the fruit fly incidence (26.4 %), when compared to control (38.22%)(Beaulah, 2001).

Tomato

Malathy (2003) found that in tomato, the hybrid H24 x CLN 2123 A showed greater response for the application of panchagavya. it was found that the treatment combinations of panchagavya 5 % at nursery stage and 40 days after transplanting + coconut milk spraying (10 % once in a week for 3 times) recorded the highest number of fruits per plant of 71.40, followed, by 71.0 in the panchagavya 5 % spray at nursery stage alone (T4) whereas the control registered the loest number of fruits of 43.25. similarly, the fruit quality parameters *viz.,* TSS, total acidity and

ascorbic acid contents were also the highest in the same treatment (7.5 ^{0} Brix, 0.73 % and 16.8 mg/100g respectively).

Medicinal Coleus

In a study conducted with Coleus forskohlii, application of panchagavya 4% spray was found to be superior in respect of root yield (12.40 kg/plot) as compared to control (5.23 kg/plot). Similarly, number of roots (14.99), root length (13.73 cm), root diameter (2.49) and root weight (459.35 g/plant) were the highest in the above treatment (Kanimozhi, 2003).

Investigation on the effect of different growth promoters on the growth, yield and alkaloid content of *Coleus forskohlii* was carried out at the Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore from Dec 2002 to May 2003.Organic growth promoters included in the study were panchagavya a natural organic product at different concentrations (2, 3 and 4 %), Moringa leaf extract spray at different concentrations (3, 6 and 9 %) and the synthetic growth promoters are Cytozyme, Miraculan and Atonik at recommended doses. All the treatments were applied as foliar spray at three stages of crop growth (45, 90 and 120th DAP).

The plots treated with panchagavya at higher concentration i.e., four per cent spray showed greater response on plant height , plant spread, number of leaves, fresh and dry weight of shoot, than the chemicals and other organic growth promoters.

The physiological parameters like dry matter production, CGR, chlorophyll content and nutrient content of leaves were found to be highest in the treatment sprayed with panchagavya four per cent. Regarding RGR, LAI and HI the treatment with panchagavya three per cent recorded the highest as against control. The tuber characters *viz.,* number of tubers, tuber length and tuber diameter was influenced by the treatments panchagavya four per cent and three per cent which were equally best and regarding fresh and dry tuber weight the treatment with panchakavya four per cent registered the maximum. Fresh and dry tuber yield was highest under the treatment sprayed with panchagavya

four per cent. The total alkaloid content was the highest with the application of panchagavya four percent followed by panchagavya three per cent. Cost benefit ratio and net return were the highest and profitable under the treatment panchagavya four per cent proving its feasibility at commercial level.

Aswagandha

Field experiments were carried out at the College Orchard, Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore during 2002-2003. The bio romoters used for treatments spray include panchagavya, moringa leaf extract, cytozyme, miraculan and atonik. The study revealed that the growth parameters namely, plant height, number of laterals, number of leaves, fresh and dry weight of roots were significantly higher in plants treated with panchagavya at four per cent concentration.

A greater response was shown by the panchagavya treatment towards the flowering and fruiting characters. It promoted early flowering and recorded the highest number of flowers (480.72) and fruits (498.46) and thus contributed to the highest fruit yield (2037.53 kg hec^{-1}).A linearly increasing effect was recorded by the panchagavya treatment (T_4) on physiological parameters like leaf area index, chlorophyll content, chlorophyll fluorescence photosynthetic rate and relative water content ultimately leading to an increased crop growth rate.

The yield contributing characters like root length, root diameter, number of root primaries were significantly influenced by the application of panchagavya. A linear increase in these characters was observed with increase in age of crop. This led to higher root and seed yield by recording the highest values for root shoot ratio and harvest index.

The nutrient uptake and nutrient status of plants were significantly increased by the application of panchagavya as compared to other treatments. The total alkaloid content of the roots was higher in plants treated with panchagavya which proved to be highly efficient and superior in enhancing plant growth and yield. ost benefit ratio and net

return was recorded to be the highest and profitable under the treatment panchagavya (T_4) proving its feasibility at commercial level.

Panchagavya 2,3, and 4 % spraya and moringa leaf extract 10,20 and 30 ml/plant and chemicals cytozyme 1%, Atonic – 1% and Miraculan – 1% sprays were given. Panchagavya 4 % was found to be the best among all the treatments for gr4owth and yield characters *viz.,* plant height (145.63 cm), shoot fresh weight (976.24 g), number of fruits (498.46), fruit yield (64.74 g/plant) and root length (54.21 cm), whereas in the control, it was only 98.48 cm, 720.61 g, 348.67,36.23 g/plant, 38.62 cm respectively (Cynthia, 2003).

In Ashwagandha, the yield attributes *viz.,* root length (50.67 cm), root girth (4.93cm), root primaries (6.50cm), root fresh weight (96.33g), dry weight (38.27 g) and root bark weight (22.33g) per plant were the highest in the treatment pinching + wider spacing+ panchagavya (3% spray). However, the treatment pinching + closer spacing (60 x 30 cm) + Panchagavya (3%) registered the highest root yield of 1350 kg/hectare (Saraswathy, 2003).

Bhendi

Muthuvel (2002) recorded higher plant height, number of branches per plant, number of fruits per plant and fruit yield than the control (water spray). An experiment was conducted to study the effect of Panchagavya and moringe leaf extract on growth and yield of bhendi "Varsha Uphar" at Coimbatore. Four sprays of panchagavya 3 % and moringa leaf extract (25 ml/plant) starting from 2 weeks after sowing and subsequently at 15 days interval were given. Both panchagavya and moringa leaf extract registered the higher plant height and number of branches, while the number of fruits and fruit yield were the highest in panchagavya treated plants.

Rose

Thamaraiselvi (2001) conducted an experiment conducted on the physiology of petal shedding in Edward rose and red rose. It was found

that the treatment calcium acetate 0.5 % + panchagavya 5 % significantly influenced the morphological characters such as the flower diameter, pedicel length, receptacle diameter, number of petals and petal: receptacle ratio. The treatment panchagavya 5 % resulted in earlier flowering of 45.6 days and 53.31 days in Edward rose and Red rose respectively.

In maize (CO – 1), basal application of 10 t ha $^{-1}$ of bio gas slurry along with foliar application of Panchagavya 3 per cent during 15th,30th, 45th and 60th day after sowing recorded the maximum grain yield of 8.34 and 8.05 t ha^{-1} during 2001 and 2002 respectively. It was at par with recommended doses of NPK (8.24 and 8.19 t ha^{-1}) and foliar spray. In sunflower also basal application of 3.5 t ha^{-1} of bio gas slurry along with foliar application of Panchagavya 3 per cent during 15th, 30th, 45th and 60th day after sowing recorded the highest seed yield of 3.16 and 3.24 t ha^{-1} during 2001 and 2002 respectively. In green gram, the basal application of 2.5 t ha^{-1} bio gas slurry along with foliar application of Panchagavya 3 per cent during 15th , 25th , 40th and 50th day after sowing recorded the highest grain yield of 15.28 and 12.33 q ha^{-1} during 2001 and 2002 respectively. It was at par with the recommended doses of NPK (16.14 and 13.72 q ha^{-1}) as foliar spray (Somasundaram 2002 a).

In green gram (CO-4) basal application of FYM @ 12.5 t ha^{-1} along with foliar application of Panchagavya 3 per cent during 15th, 25th, 40th and 50th day after sowing recorded the highest grain yield and BCR (Somasundaram 2002b).

Solanum nigrum

Field experiment was conducted during October-2003 to May 2004 at the Horticultural College and Research Institute, Coimbatore to standardize protocol for maximization of growth, yield and alkaloid content in black nightshade (*Solanum nigrum* L.). The experiment was laid out in a split plot design with three replications. The treatments consisted of four levels of spacing (M_1 – 30 x 30cm, M_2 – 45 x 45cm, M_3 – 60 x 30cm and M_4 – 60 x 45cm) and nine bio-stimulants/organics (S_1–

Recommended dose of fertilizer (RDF), S_2 – control, S_3 – panchagavya 2 per cent, S_4 – panchagavya 3 per cent, S_5 – moringa leaf extract 2 per cent, S_6 – moringa leaf extract 4 per cent, S_7 – humic acid, S_8 – cytozyme 1 per cent and S_9 – vermicompost).

The results indicated that highest plant height was recorded in closer spacing + cytozyme combination next to closer spacing + RDF. This was on par with closer spacing + panchagavya (3 per cent). Lesser value for this trait was observed in wider spacing + control. The other morphological attributes such as plant spread, number of branches, leaves per plant, leaf area and root length were at the highest under wider spacing + panchagavya (3 per cent) next to wider spacing + RDF, followed by humic acid treatment. The least number of branches, plant spread, number of leaves, leaf area and root length were registered under closer spacing + control.

Maximum value for yield attributes *viz.,* dry weight of leaves and shoots, fruit fresh weight, fruit dry weight, fresh and dry weight of leaves at harvest, herbage yield per plant were observed under wider spacing + RDF followed by panchagavya (3 per cent), however the number of fruits per plant was higher under wider spacing + humic acid treatment.

The physiological parameters *viz.,* chlorophyll fluorescence, relative growth rate, soluble protein, specific leaf weight and total dry matter production were also at higher range under wider spacing + RDF followed by panchagavya (3 per cent) and humic acid application. The crop growth rate (GCR) and LAI were higher under closer spacing + RDF followed by panchagavya and humic acid treatment.

Maximum values for quality attributes *viz.,* ascorbic acid both in leaves and fruits and TSS content were observed under wider spacing + RDF followed by humic acid and panchagavya (3 per cent). The minimum values for the same parameters were registered under closer spacing + control.

Biochemical observation revealed that the lowest crude fibre and the highest alkaloid content were registered under wider spacing + panchagavya (3 per cent) next to wider spacing + RDF followed by humic

acid. The highest solasodine content was registered in wider spacing + RDF followed by panchagavya sprayed plants.

The economic analysis forwarded the treatment combination of closer spacing (30 x 30cm) + panchagavya (3 per cent) which registered more gross income, net returns and BCR. This treatment was on par with closer spacing + RDF. Thus, closer spacing + panchagavya (3 per cent) can be recommended for commercial cultivation and exploitation of black nightshade.

Panchagavya as immunity Booster

Panchagavya spray at the rate of one per cent reduced the flower drop, increased fruit size, retained freshness and enhanced taste in fruit crops and provided protection from green worms as experienced in Hosakere village of Karnataka (*www.green conserve.com).*

A research carried out at TRRI, Aduthurai concluded that a foliar spray of cow dung extract twice and cow's urine at 10 days interval from 24 hours after inoculation of bacterial leaf spot reduced the disease intensity. The cow dung extract (20 %), as a foliar spray produced a maximum yield of 5050 kg per hectare and it effectively checked bacterial leaf spot infestation, followed by cow's urine spray recording a high yield of 4900 kg per hectare over the control (4120 kg per hectare).

It was also inferred that spraying a mixture of 500 ml of sweet flag extract, 500 ml of cow's urine and 100 ml of khadi soap extract at two weeks interval along with fumigation by the smoke of embelia ripen fruit powder controlled Panama wilt in banana.

Natarajan (2002) reported that five per cent spray of panchagavya on paddy crop affected by bacterial blight, controlled the disease incidence within one week of spray completely. Jayashankar *et al.* (2002) inferred that 0.9 per cent of cow's urine as foliar spray by a low volume hand sprayer effectively controlled the cercospora leaf spot in field beans. Soil drenched with Maha Panchagavya (MPG) slurry 10 per cent, effectively controlled the wilt of tomato stated that panchagavya spray

with *Agnihotra* (fumigating the field) recorded the least population of cutworms and highest yield of potato.

The modified form of panchagavya (MPG 3), a mixture of two volumes of ghee, five volumes of each of curd and milk, 40 of urine and 48 of dung, two percent of common salt and 0.01 percent of bakers yeast was found to be most effective and economical. This was then slurry filtered and the filtrate was diluted 10 times. The ph of the filtrate was maintained at 6.6. The filtrate was first applied on the roots of tomato seedlings and later for spot application after they were transplanted, in the soil previously inoculated with pathogen. It was found that MPG 3 was found to be superior than carbendazim in reducing the plant disease index and increase the vigour of the plant and yield. This also revealed that MPG 3 has inhibitory effect on Fusarium oxysporum cubens which causes banana wilt. (Padmodaya 1996)

Farmers experience

Mango:

- Induce dense flowering with more female flowers
- Irregular or alternate bearing habit is not experiences leading to regular fruiting
- Enhances keeping quality by 12 days in open room temperature
- Develops extraordinary flavour and aroma.

Acid lime:

- Continuous flowering is ensured round the year.
- The fruits are plump with strong aroma.
- Shelf life is extended by 10 days.

Guava:

- Higher T.S.S
- Shelf life is extended by 10 days.

Banana:

- Uniform bunching is attained by applying 3 % solution of panchagavya to the navel end of the bunch after the male bud is removed.
- Early harvesting by one month was witnessed
- Size of top and bottom hands was uniformly big.

Vegetables:

- Yield enhancement by 18 percent and in few cases like cucumber , the yield is doubled
- Wholesome vegetables with shiny and appealing skin
- Extended shelf life
- Very tasty with strong flavour.

Tomato

Increased the fruit number, fruit weight and fruit quality. (Total acidity and Ascorbic acid)

Bhendi:

Increased the plant height, number of branches /plant, number of fruits/ plant and fruit yield.

Radish:

- More number of leaves, leaf area and leaf area index
- Higher dry matter production
- Recorded highest harvest index and tuber yield

Turmeric:

- Enhances the yield by 22 %
- Extra long fingers
- Ensures low drying loss
- Narrows the ratio of mother and finger rhizomes
- Helps survival of dragon fly, slugs, spider etc. which in turn reduce pest and disease load
- Sold for premium price as mother / seed rhizome
- Enriches the curcumin content.

Jasmine:

- Exceptional aroma and fragrance
- No incidence of bud worm

- ❖ Continuous flowering through out the year.

Modified panchagavya

Panchagavya, by name constitutes five products evolving from cow. Rural Community Action Centre (NGO) has modified this Panchagavya by adding a few more ingredients and this modified version has a lot of beneficial effects on a variety of crops and livestock. The present form of Panchagavya standardized by TNAU is a single organic input which can act as a potentiator. It is essentially a product containing the following:

Sl.No	Ingredients	RCAC	TNAU Standard
01.	Cow dung slurry (from Gobar gas plant)	4 Kg	-
02.	Fresh cow dung	1 Kg	5.0 kg
03.	Cow's urine	3 litre	3.0 lit
04.	Cow's milk	2 litre	2.0 lit
05.	Cow's curd	2 litre	2.0 lit
06.	Cow's ghee	1 Kg	1.0 kg
07.	Sugarcane juice	3 litre	3.0 lit
08.	Tender coconut water	3 litre	3.0 lit
09.	Banana (ripe)	12 Nos	1.0 kg
10.	Toddy (if available)	2 litre	-
	Total Quantity	**22.lit**	**20.0 lit**

The cost of preparation may be approximately Rs. 40 .00 per litre

Mode of preparation:

The above ingredients are added to a wide mouthed mud pot, concrete tank or plastic cans as in the order listed above. The container should be kept open under shade condition and the contents of the container are stirred twice in a day, both in the morning and evening. The panchagavya stock solution will be ready after seventh day and it had a shelf life of six months under normal conditions. The products of local breed of cow is said to have more potency than exotic breeds and care should be taken not to mix buffalo products. The cost of production of a litre of Panchagavya is around Rs. 35, and it can be brought down substantially if the farmers use their own cows' products.

Methods of application

The panchagavya can be applied in different ways like foliar spray through irrigation and as seed/ seedling treatment. A 3 % solution has been found to be the most effective in increasing the production and consumption of organic produces.

Foliar spray system:

Investigations prove that 3% solution was found to be the most effective compared to the higher and lower concentration. Three litres of panchagavya to every 100 litres of water is the ideal recommended dosage for all the crops. The power sprayer of 10 litres capacity may need 300 ml/ tank. When sprayed with power sprayer, sediments are to be filtered and when sprayed with hand operated sprayers, the nozzle with higher pore size has to be selected.

Flow/irrigation system:

In the case of flow or irrigation systems the solution of panchagavya can be mixed with irrigation water a6t 50 litres per hectare either through drip or flow irrigation.

Seed/seedling treatment:

3 % solution of panchagavya can be used to treat the seeds and seedlings by soaking and dipping before planting. Soaking for 20 minutes is sufficient. Rhizomes of turmeric, ginger and sets of sugarcane can be soaked for 30 minutes before planting. In the case of seed storage 3 % panchagavya solution can be used to dip the seeds before drying and storing them.

Frequency of spray:

Pre flower phase (20 days after planting)	Once in 15 days, two sprays depending upon duration of the crops.
Flowering and pod setting stage	Once in 10 days, two sprays
Fruit / pod maturation stage	Once during pod maturation

Panchagavya as Potentiator

Panchagavya is neither a nutrient, nor a hormone , nor an enzyme but a potentiator of living cells. The genetic potential of living cells does

not express themselves in as much as there are deficiencies due to biotic or abiotic factors. The metabolic activities are restricted to the expressible genetic potential and by restoring the hundred percent biological efficiency of a living cell, the genetic potential get expressed through various physiological and biochemical processes without any stress or restriction. This factor is confirmed by the following experimental evidences in plants , animals and human system:

Milk

Culture	**Bacteriocin**
Lactobacillus acidophilus	Acidophilucin A
	Acidophilin
	Lactacin B & C
Lactobacillus deslbrueckii subsp lactis	Lactacin A & B Lactobacillin G4
Lactobacillus deslbrueckii subsp bulgaricus	Bulgarican
Lactobacillus haveticus	Helvetican J
Lactobacillus plantarum	Lactolin
Lactobacillus reuteri	Reutiricin 6
Pediococcus acidilactici H PACIO	Pediocin ACH Bacteriocin
Propioni bacterium jensenii *Pediococcuss pentosaceus*	Jenseniln
	Baefericin

(Aneja et al, 2000)

Dung

- When urease enzyme in dung breaks down into urinary urea, traps carbon di-oxide and gets converted into urinary carbonate which kills all the pathogenic organisms. When Cowdung and

urineare mixed @ 1:1 ratio, virtually all of the *E.Coli were killed* (Russel, JB.2000)

- Cow dung contains a substance similar to penicilin, which has adisinfecting effect and reduce bacteria. Cow dung is used to coat th espace shutte to protect the astronauts from the cosmic radiation. The army tent has a jute layer smeared with cowdung in between the two cloth layer (Sharmila Priyadarshini 2004)

- A bacteriophage (Mx-1) infecting Myxococcus xanthus FBI has been isolated from cow dung. (Robert P.Burchard and Martin Dworkin, 1965).

- An exponential linear destruction was observed for Escherichia coli O157:H7 and a Solmonella typhimurium in cattle manure and slurry stored at 4,20 and 30 degree Celcious.

- With increase in cow dung dose, biochemical oxygen demand increased significantly. Dissolved oxygen remained significantly high. Accumulation of organic carbon, total N, P and soluble P increased.

- The reactor packed with cow manure could most effectively remove heavy metals in the treatment of acid mine drainage. The laboratory scale up flow anaerobic bioreactor filled with granular sludge and cow manure was operated and effectively removed most of the heavy metals in the orders of Cu2 + Cd2+Zn2+ Fe2+Mn2. The heavy metals were mostly precipitated in the form of metal sulfiders by sulfate reduction (www.bio.kaist.ac.kr)

- Anaerobic micro organism form cow manure was used to reduce Trinitrololvene (TNT) during anaerobic phase and get detoxified (Thielse, S.Fernades and Bollagim 2002).

- Dung in another source of organic matter and potential home for sapotrophs. Herbivore during supports a wide variety of coprophilous fungi.

- Dung in rich in water soluble vitamins, growth factors, mineral irons, same of which are metabolic by products of the microbes in a herbivoures got. Eg. coprogen, an organo – iron compound found in during is necessary for the growth and reproduction of the fungus pilobolus crystallinus. Dung also contains a large amount of ready available carbohydrates (Juliana T. Hauser, Caroling Biol. Company) (www.accessexcellence.org)

Curd

- Aneja et al(2002) identified antibiosis effect in panchagavya due to the fermented milk. Viable lacto bacillus organisms present in it can de conjugate bile salts in the intestine and serve as a source of food borne pathogens. Further, organic acids like acidic propionic and lactic acid present in fermented milk can cause antibiosis. Lactic acid present in fermented milk can penetrate into the bacterial cell wall of *Salmonella enteritidis* and *E.Coli*, there by inhibiting their growth.
- *Bacillus subtilis,* present in the curd is a known immune – stimulating bacteria and all health promoting substance and is prescribed for dysentery and other intestinal problems (Cholera). The cell wall components of ingested bacillus subtilis is able to activate nearly all systems of the human immune defense including the activation of atleast three specific antibodies (IgM, IgG and IgA secretion) which are

highly effective against many of the harmfull viruses, fungi and bacterial pathogens.

- Fermented milk (curd) has immuno modulating effect (Mathur et al 2001)
- The probiotics may compete with pathogens for the same adhesive sites and consequently may prevent infection (Syndifrai , 2002)
- Bacteriocins produced by the curd are bioactive peptides or peptide complexesthat have a bactericidal or bacteriostatic effect on other species.
- Curd has anti carcinogenic activity (Strand M and Babus,1997)
- Curd and whey protein supplement appears to inhibit Angiotension Converting Enzymes and lowers blood pressure.
- Fermented milk has prophylactic and therapeautic activities (Hitchins. and McDonough, (1989).
- Curd contains Bifidobacterium lactis and has enhanced the natural immune function.

Ghee

- Ghee provides protection from bacterial infections. Conjugated linolic acids (CLA) are a class of fatty acids, found in ghee. They are strong antioxidant constituents of milk fat and may prevent colon cancer and breast cancer and have been shown to enhance the immune response. It also reduces heart diseases by reducing the levels of prostaglandin PGE2 that promotes inflammation, artery constrictions and blood clotting.It normalizes the blood glucose level by increasing insulin sensitivity.CLA of ghee inhibit colon cancer reduce serum cholestrol and elevate good cholesterol (Aneja et al, 2002)

- Ghee possess healing properties that many oils just can't boast. The ability of ghee to support physical and mental renewal has been substantiated by science. Ghee contains butyric acid, a fatty acid that has antiviral and anti – cancer properties. (Pritchford P.1993)

- Ghee applications to the umbilical cord: a risk factor for neonatal tetanus.

Urine

- Plasma ultra filtrate.
- Has known healing agents.
- Has melatonin and muramyl di peptide hormones to regulate sleep and calming effect.
- Has urea – antibacterial, antifungal and virus properties by causing osmotic imbalance on pathogens.
- Cosmetic soaps are prepared with cow urine. (Natallie Bouaralong, 2002)

TNAU Panchagavya

Panchagavya is an important component of organic farming. The contents are ghee, milk, curd, cow dung and cow's urine, sugarcane juice or jaggery, tender coconut water, ripped banana, which revitalize the growth process.

- Panchagavya acts as organic manure, biostmulant and gives resistance against pest and diseases.
- It contains all macronutrients, micronutrients and growth hormones (IAA and GA) required for crop growth.
- Panchagavya contains the beneficial microbes such as yeast and Lactobacillus which produces antibiotics which are effective against pathogenic bacteria and fungi besides its growth promoting effect.

- Cow's urine contains uric acid, which acts as manure and hormones.
- Tender coconut water is a cheaper substitute for kinetin which increases the chlorophyll content.
- Seed treatment with panchagavya enhances germination of seeds and vigour index of seedlings.
- Generally panchagavya is recommended for all the crops as foliar spray at 3% level (3 litre Panchagavya in 100 litres of water).

Crops	:	Time schedule
Rice	:	10,15,30 and 50th days after transplanting
Sunflower	:	30,45 and 60 days after sowing
Blackgram	:	Rainfed : 1st flowering and 15 days after flowering Irrigated : 15,25 and 40 days after sowing
Green gram	:	15, 25,30,40 and 50 days after sowing
Castor	:	30 and 45 days after sowing
Groundnut	:	25 and 30th days after sowing
Bhendi	:	30,45,60 and 75 days after sowing
Moringa	:	Before flowering and during pod formation
Tomato	:	Nursery and 40 days after transplanting, seed treatment with 1% for 12 hrs
Onion	:	30,45 & 40 days after transplanting
Rose	:	At the time of pruning & budding
Jasmine	:	Bud initiation and setting
Vanilla	:	Dipping setts before planting

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